

What is claimed is:

1. A voice coil actuator comprising

a first magnet having a length;

a second magnet having a length;

5 a first soft magnetic pole piece having a length greater than the length of the first magnet and the length of the second magnet, wherein the first and second magnets are positioned at different ends of the first soft magnetic pole piece and magnetized in opposite directions;

10 a coil having a length less than the lengths of the first soft magnetic pole piece and positioned for travel along an axis common to the first soft magnetic pole piece and first and second magnets; and

a structure which provides a magnetic path between free ends of the first and second magnets.

15 2. A voice coil actuator comprising

a first magnet;

a second magnet;

20 a first soft magnetic pole piece positioned between the first and second magnets along a common axis, wherein the first and second magnets are magnetized in opposite directions, and the first soft magnetic pole piece has a length greater than a length of the first magnet and a length of the second magnet along the common axis;

a coil having a length less than the length of the first soft magnetic pole piece and positioned for travel along the common axis; and

a structure which provides a magnetic path between free ends of the first and second magnets.

3. The voice coil actuator of claims 1 or 2, wherein the length of the first magnet
5 is substantially the same as the length of the second magnet.

4. The voice coil actuator of claims 1 or 2, wherein the length of the first magnet
10 is substantially twice the length of the second magnet, and further wherein the structure includes a second soft magnetic pole piece positioned along the common axis at the free end of the first magnet and having a length no greater than the length of the first magnet, and a shell portion which extends from a point near the second soft magnetic pole piece to the free end of the second magnet.

15 5. A closed-ended cylindrical voice coil actuator comprising
a first magnet;
a second magnet;
a first soft magnetic pole piece positioned between the first and second magnets along a common axis, wherein the first and second magnets are magnetized in opposite directions, and the first soft magnetic pole piece has a length greater than a length of
20 the first magnet and a length of the second magnet along the common axis;

a coil having a length less than the length of the first soft magnetic pole piece and positioned for travel along the common axis; and

a shell of magnetically permeable material positioned about the first and second magnets and the first soft magnetic pole piece, coupled to the free ends of the first and second magnets, and having two longitudinal slots through which a coil assembly is linked to the load.

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6. A open-ended cylindrical voice coil actuator comprising

a shell of magnetically permeable material;

a first magnet;

a second magnet;

a first soft magnetic pole piece positioned between the first and second magnets along a common axis, wherein the first and second magnets are magnetized in opposite directions, and the first soft magnetic pole piece has a length greater than a length of the first magnet and a length of the second magnet along the common axis;

a coil having a length less than the length of the first soft magnetic pole piece and positioned for travel along the common axis; and

a second soft magnetic pole piece positioned at a free end of the first magnet, wherein the shell is positioned about the first and second magnets and the first and second magnetic pole pieces to provide an open end at the second magnetic pole piece and to be in contact with the second magnet.

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